Research Note 2002-15

Bradley M2A3/M3A3 Embedded Training System (BETS): Initial User Assessment

Kelly Leigh Birchfield Rich
Auburn University
Consortium Research Fellows Program

Margaret S. Salter
U.S. Army Research Institute

Infantry Forces Research Unit
Scott Graham, Chief

August 2002

United States Army Research Institute
for the Behavioral and Social Sciences

U.S. Army Research Institute for the Behavioral and Social Sciences

A Directorate of the U.S. Total Army Personnel Command

Michael G. Rumsey
Acting Technical Director

Technical review by

Richard E. Christ, ARI

NOTICES

DISTRIBUTION: This Research Note has been cleared for release to the Defense Technical Information Center (DTIC) to comply with regulatory requirements. It has been given no primary distribution other than to DTIC and will be available only through DTIC or the National Technical Information Service (NTIS).

FINAL DISPOSITION: This Research Note may be destroyed when it is no longer needed. Please do not return it to the U.S. Army Research Institute for the Behavioral and Social Sciences.

NOTE: The views, opinions, and findings in this Research Note are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision unless so designated by other authorized documents.

REPORT DOCUMENTATION PAGE

1. REPORT DATE (dd-mm-yy)	2. REPORT TYPE	3. DATES COVERED (from. . . to)
August 2002	Final	May 2002 – July 2002

4. TITLE AND SUBTITLE	5a. CONTRACT OR GRANT NUMBER
Bradley M2A3/M3A3 Embedded Training System (BETS): Initial User Assessment	
	5b. PROGRAM ELEMENT NUMBER 65803
6. AUTHOR(S) Kelly L. B. Rich (Auburn University) & Margaret S. Salter (U.S. Army Research Institute)	5c. PROJECT NUMBER D730
	5d. TASK NUMBER 261
	5e. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
U.S. Army Research Institute for the Behavioral and Social Sciences ATTN: TAPC-ARI-IJ 5001 Eisenhower Avenue Alexandria, VA 22333-5600	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. MONITOR ACRONYM
U.S. Army Research Institute for the Behavioral and Social Sciences 5001 Eisenhower Avenue Alexandria, VA 22333-5600	ARI
	11. MONITOR REPORT NUMBER Research Note 2002-15

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT *(Maximum 200 words)*:

This report documents a limited user test of the prototype Bradley Embedded Training System (BETS). The BETS is designed to be an on-vehicle system, using vehicle hardware and software, and the same training device software as the already fielded BATS, Bradley Advanced Training System. Nineteen M2A3 Bradley-qualified soldiers performed two gunnery exercises using the BETS and reported their initial impressions about the device and its potential usage. Preliminary results indicated that user satisfaction was high, and potential good. Further research is necessary to determine BETS use in training and operational environments.

15. SUBJECT TERMS

Bradley Fighting Vehicle Bradley Advanced Training System (BATS)
Embedded Training Device Gunnery Training

SECURITY CLASSIFICATION OF			19. LIMITATION OF ABSTRACT	20. NUMBER OF PAGES	21. RESPONSIBLE PERSON (Name and Telephone Number)
16. REPORT	17. ABSTRACT	18. THIS PAGE			
Unclassified	Unclassified	Unclassified	Unclassified	15	Margaret S. Salter DSN 835-2485

CONTENTS

Bradley M2A3/M3A3 Embedded Training System (BETS): Initial User Assessment

Introduction

The Bradley Embedded Training System (BETS) is an on-vehicle version of the Bradley Advanced Training System (BATS) and was, like the BATS, designed by United Defense Limited Partnership (UDLP). The BATS is the major simulation system-training device for Bradley Fighting Vehicle (BFV) personnel using the A3 version of the Bradley. Similar to the BATS, the BETS can be used as a precision gunnery trainer for individuals, crews, and units. The BATS allows soldiers to engage in gunnery skills training on the Bradley A3 system using software that fully integrates computer graphics featuring a virtual battlefield display through the system viewing devices. The training simulation replicates visual displays that a Bradley crew could face on a battlefield. The BETS, like the BATS, can simulate a battlefield environment with targets, ranges, climate, topography, and threat situations likely to be presented to a Bradley crew. What distinguishes the BETS from predecessor devices is that it is an embedded trainer. It permits training to occur using actual vehicle equipment (turret, hand stations, and sights).

Description of Bradley Embedded Training System (BETS)

The BETS is a prototype training device. As currently configured, it consists of an apparatus mounted in the bustle rack of a M2A3/M3A3 BFV. It allows assessment of training and exercises on the operational BFV and auxiliary equipment. The system overlays the BFV normal operational mode when a session is initiated for training and assessment purposes. The BETS is powered by the Bradley. The hardware and software process and digitally present terrain and target data to realistically simulate what might be seen during an actual operation. Exercises can be conducted in a variety of simulated environments including day, night, and adverse weather conditions, although degraded modes are not yet available. Realistic interaction occurs between the user and the vehicle controls and the Bradley commander is able to observe and respond to all facets of the training events from his regular user's interface.

Problem

The newly developed BATS appears to be a reliable BFV crew trainer. The gunner and Bradley Commander (BC) can train on turret skills from initial manipulation through a simulated gunnery Table XII. Precision gunnery and combat gunnery training are possible. However, there are only thirteen prototype BATS fielded, and only eleven additional BATS planned for the institutional training environment over the next year. One emerging issue with the BATS is that like its predecessor Conduct of Fire Trainer, it lacks mobility and hence forces the soldiers to go to the device. This frequently means coming in from a field environment, and scheduling use of the BATS throughout the day and night to accommodate all of a unit's crews. There are also complaints that the BATS does not adequately replicate the "feel" of the vehicle despite the fact that the design specification of most BATS features are identical to the BFV. The BETS was designed as a supplement to the BATS that might more realistically simulate actual vehicle training while providing an identical simulated gunnery experience. Although UDLP personnel

had demonstrated the device in several public forums, no systematic data collection effort had occurred.

Objective and Limitations

Personnel from the Office of the TRADOC Systems Manager-Bradley (TSM-B) requested that the U.S. Army Research Institute (ARI), Fort Benning, assist in conduct of an initial user assessment of the BET. The intent was to test the ease with which experienced Bradley personnel could use the BETS and their overall satisfaction with the training device. It was understood that the sample size would be very limited and that the prototype BETS would need to be enhanced and ruggedized in the future. It was understood also that test scenarios would be limited to two easily used demonstration exercises. However, researchers anticipated that the test would provide an adequate initial indication of the potential value of the BETS as a simulated gunnery training device.

Methodology

The assessment was conducted jointly by TSM-B, the prime contractor UDLP, the 29th Infantry Regiment's Bradley Proponency Office (BPO), and ARI. The TSM-B office served as the primary point-of-contact and UDLP personnel ensured that the system was technically operational during the assessment. The BPO personnel selected scenarios, served as the Bradley Commander and as the Instructor/Operator (I/O) as needed and maintained necessary records. Personnel from ARI designed the survey questionnaire and interview, collected responses, and analyzed data. The test ran from May 28 through May 29, 2002.

Participants. Personnel from the BPO secured test participants who were experienced with the BFV. In addition, BPO personnel scheduled the participants and ensured that the schedule was maintained. The BPO requested 20 experienced Bradley personnel. Nineteen male military personnel arrived and participated in the user assessment.

Materials. Materials included a Bradley, a BETS, and associated hardware and software. Survey instruments included an experience survey to ascertain personal Bradley experience and demographic information (see Appendix A). ARI also administered structured interview questions designed to assess satisfaction with and ease of use of the BETS (see Appendix B). (See Bernard and Alban (2001), and Salter (2001) for more information on the BETS and the M2A3 respectively.)

Test site preparation and logistical support. All testing occurred at Building 5500, the Collins Training Center, at Fort Benning. Prior to the assessment, UDLP personnel worked in conjunction with personnel from the BPO to arrange logistical support and to prepare the testing facility, the BFV to be used, and the BETS installed in the BFV. The site, including a BFV bay and an adjacent classroom, met electrical power requirements for the necessary technical hardware.

Because of ventilation needs, the BFV was located outside a BFV bay. UDLP personnel were located inside the bay monitoring software and hardware performance. The Bradley was at

all times stationary, vehicle power was on, and the ramp was down throughout the testing. Surveys were administered in the classroom. In addition to the vehicle and the BETS technical equipment, tables, benches, and chairs were provided for test administrators, survey respondents, and observers.

Daily schedules and procedures. Two personnel from the BPO alternated as BC. This provided a standardized situation for each participant. On the first testing day, seven participants arrived and participated at 30 minute intervals. Each participant initially completed the experience survey and returned it to ARI personnel. The participant then accompanied BPO personnel to the test vehicle to fire the two pre-selected Combat Exercises. These demonstration exercises (numbers 99998 and 99999, defensive position, moving and stationary targets and own vehicle) were chosen as those most likely to provide the gunners a reasonable chance of achieving success. Upon completion of the exercises, each participant returned to the classroom to answer structured interview questions administered by ARI personnel. On the second testing day, 12 participants arrived and participated at 30 minute intervals and each completed the same sequence of events.

Results and Discussion

Test participants were not evaluated on their ability to successfully fire upon presented targets. Instead, the test was designed to evaluate satisfaction with and ease of use of the BETS. Therefore, no data were collected about gunner performance.

Demographics

All of the participants were active duty personnel, with time in service ranging from 1 year 10 months to 19 years 3 months (average 11 years). Their ranks ranged from Specialist to Sergeant First Class. Each had training and experience with the BFV and associated training devices although none had prior experience with the BETS. Many personnel had participated in training center rotations and several participants served as BFV crewmembers in hostile or peacekeeping missions. Most participants had some computer experience. (See Appendix A).

Test Equipment Considerations

The equipment, hardware, and software functioned well during the test. There were a few problems, however, which appeared to affect soldiers' evaluations. One problem involved zeroing. The sights when zeroed for Armor Piercing (AP) rounds would not hold the zero for High Explosive (HE). Although AP was accurately zeroed, to fire HP participants had to fire short and to the right every time. This was a training distracter, mentioned by most of the soldiers. In addition, a software malfunction occurred during one soldier's trial. However, he was able to complete one of the two exercises and was able to contribute when asked structured interview questions. The software malfunction was corrected and did not impact other participants.

Responses to Structured Interview

Soldiers individually were asked 17 questions (see Appendix B) to assess their satisfaction with the BETS and their perceptions of the system's ease of use. An ARI representative who was present throughout the testing administrated the individual interviews. Participants appeared to feel comfortable before the formal interview sessions and frequently offered unsolicited comments throughout the test. Although the interviewer guided the questions, the soldiers were encouraged to speak freely and to provide any feedback that they wished. Soldier responses are summarized below with responses to some questions grouped as appropriate.

Throughout the user assessment, all 19 respondents expressed some positive impressions of the device. One soldier, upon emerging from the vehicle, exclaimed, "I liked it – I wish I could do it again." Another commented, "I loved it. I want one." Given enough money and device reliability, all 19 participants indicated that they probably would buy the device.

The first question asked about the best features of the Embedded Trainer device. Fifty-three percent of the respondents indicated that better training might occur with the device since it is on-board the vehicle and since it is more mobile than other training devices. Thirty-two percent of respondents made positive comments about the graphics quality and 26% mentioned the realism provided by ambient conditions inherent to the BFV. These consisted of comments about turret vibration and the fact that the BATS' hand stations do not exactly replicate vehicle hand stations.

Soldiers identified major shortfalls or problems with the device, as well. All responses to this second question were related to technical problems. Many (47%) discussed difficulty zeroing the 25mm weapon, and 26% mentioned a slight, approximately 5-second delay that occurred when switching from low magnification to high magnification. Twenty-six percent also commented on delayed, "twitchy," or shaky graphics. Also, four (21%) soldiers mentioned that realism was diminished because there was no sound accompanying the graphics. Given the opportunity to suggest enhancements to the device, respondents explained that they would add sound effects (26%), a mechanism to record performance data (26%), and would find a way to incorporate the driver into training (21%).

Most respondents conveyed their impressions that the primary crew training advantages of the system were related to its mobility and accessibility. They thought that having a large number of devices available was important to training enhancement. Asked about the potential basis of issue for the device, 63% said that each platoon should have one or two devices, and 21% suggested one per vehicle. The remainder (16%) thought that there should be at least two or three per company.

Seventy-eight percent of respondents indicated that the BETS would provide added training value to an individual, a crew, or a unit because training could occur in any location without time or scheduling restrictions (if available on numerous vehicles) since training could occur in the field instead of troops returning to the rear. Training could focus on the individual or involve the entire crew. When asked how they would use the BETS to train, 58% of the

soldiers indicated that they would use it as part of their unit's home station training for familiarization, to re-train or sustain training, and to train for gunnery certification. Respondents overwhelmingly (84%) expressed the opinion that the BETS would be a good Table VIII gunnery training device. In addition, 16% mentioned that it could be used to help with crew coordination.

Participants indicated that the BETS could be used in institutional training with other training devices such as the BATS or COFT. Many (37%) respondents indicated that they would use the device with the BATS if both were available, but 37% stated that the BETS could eventually replace the BATS. Seventy-nine percent felt it could be used in a hostile theatre, especially to maintain skills (time and alert status permitting). Eighty-four percent responded that the BETS could be used during a peacekeeping mission, especially to enhance or maintain skills training. Ninety-five percent of the soldiers said that the device would enhance combat readiness when deployed in or outside of the continental United States because of added training opportunities.

Some (47%) respondents thought the BC or squad leader could be trained to evaluate performance and to provide feedback. Others (32%) felt, for the most part, that the BETS would not require an I/O if the system could be designed (using a diskette system) to provide textual feedback that could be reviewed later. However, 21% recognized that an I/O might still be needed to rapidly identify and correct errors, and because an I/O would have additional training that would provide a different perspective.

Conclusions and Suggestions for Future Research

Despite the limited nature of the initial user test of the Bradley Embedded Trainer Device, soldier support was high and another test in a field location, using battle-rostered crews, would appear warranted. The sample of soldiers tested were primarily trainers and gunners; their experiences in command positions were limited and uses other than as a gunnery device were largely unidentified. Several test subjects cited the absence of sound effects as a limitation of the BETS; they stated that if the device is fielded this shortfall would have to be corrected.

The comments on whether an I/O is needed with the Embedded Trainer were not definitive, and reflect the rather limited perspective of the specific soldiers tested. At the earliest possible time the potential for records production should be demonstrated to assist in decisions about need for an I/O. Similarly, although the training exercises for the BATS device are reportedly equally available for the BETS, more and different exercises must be shown in the BETS, to include troop targets. Based on soldier comment, some consideration should also be given to incorporating an ability for crews to practice outside their gunnery matrixes, for reinforcement of weak crews, or to train a new crewmember.

In sum, based on a very limited sample of Bradley gunners, the Embedded trainer appears worth pursuing as a potential addition to the set of Bradley training devices.

References

Bernard, R. J., & Alban, A. M. (2001). Embedded training solution for the Bradley Fighting Vehicle (BFV) A3. Orlando, FL: United Defense, L.P.

Salter, M. S. (2001). Bradley Fighting Vehicle M2/M3 A3: Training and soldier system observations. (ARI RN 2001-06). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Appendix A

Bradley Embedded Trainer – Experience Survey

PLEASE ANSWER EVERY QUESTION. Fill in the blank or circle the correct response.

1. Name:

2. Are you Active Duty***or*** National Guard ***or*** Civilian
   If military, rank _____ MOS/branch _____ **If civilian**, last rank ____MOS/branch ____

3. Time in service (years/months) _____

4. Current job/office/duty position (be specific) _____ How long? _____

5. Indicate your experience with each of the listed devices. Use the following scale:
   1 = None 2 = Very little 3 = Some 4 = Much 5 = Very much
   Conduct of Fire Trainer (COFT) _____ Simulation Networking (SIMNET) _____
   Close Combat Tactical Trainer (CCTT) _____ Precision Gunnery System (PGS)_____
   Bradley Advanced Training System (BATS) ___ Bradley Desktop Trainer (BDT) _____

6. Have you taken the Bradley Leader Course? Yes ***or*** No Bradley Master Gunner Course? Yes ***or*** No

7. Are you COFT I/O certified? Yes ***or*** No Are you BATS I/O certified? Yes ***or*** No

8. Are you an SIO? Yes ***or*** No If yes, which device? _____

9. Have you ever used the Bradley Embedded Trainer before today? Yes ***or*** No
   If yes, please describe *when* and *where* and for *what purpose* _____
   _____
   _____

10. When was your last Table VIII (month/year) _____ What was your score? ____
    What was your duty position? BC ***or*** Gunner ***or*** Driver Have you fired a Table XII? Yes ***or*** No

11. How many rotations have you participated in at the NTC ___ JRTC ___ CMTC ___

12. Did you serve in a crew position (Gunner/BC) during Desert Storm? Yes ***or*** No
    Bosnia? Yes ***or*** No Somalia? Yes ***or*** No Another hostile environment? (be specific) _____

13. Rate your computer skills: Below Average ***or*** Average ***or*** Above Average ***or*** Much Above Average

14. Please describe your M2A3 Experience and Training. *Continue on the back of the paper if needed.*

    Date of training (approx month/year) _____

    Location(s) (FT Hood, FT Benning, FT Knox, etc.) _____

    Trained by UDLP NET Team ***or*** Bradley (29th IN REG) NET Team ***or*** in a School Environment

    Duty position in the M2A3 (all that apply) BC Gunner Driver Squad Member

Are you: a vehicle operator, a trainer, a commander in a unit that has A3s, a member of the NET Team? Please describe.

Selected Demographic Information

	Yes	No
Taken the Bradley Leader Course	1	18
Taken the Master Gunner Course	8	11
COFT I/O Certified	13	6
BATS I/O Certified	5	14
An SIO	8	11
Fired a Table XII	16	3
Crew member in Desert Storm	1	18
Crew member in Bosnia	3	16
Crew member in Somalia	0	19
Crew member in Kosovo	1	18
Crew member in Kuwait	1	18

Experience with devices

	None	Very Little	Some	Much	Very Much
COFT	1	3	0	6	9
CCTT	2	6	5	4	2
BATS	2	3	9	5	0
SIMNET	2	5	5	7	0
PGS Percent	0	3	7	4	5
BDT	11	2	2	3	1

Computer Skills

Below Average	Average	Above Average	Much Above Average
4	9	3	3

Appendix B

Bradley Embedded Trainer – Structured Interview

1. What were the best features of the Bradley Embedded Trainer?

2. What were the major shortfalls of the Bradley Embedded Trainer?

3. How would this device provide added training value to an individual or crew or unit?

4. How would you utilize this device as a part of your unit's home station training?

5. How might you use the BET in conjunction with the BATS?

6. Would this be a good Table VIII gunnery training device? YES or NO. Why?

7. Could you perform the full engagement sequence with the primary sight? YES or NO. Why?

8. If evaluation is done automatically (by the device), is an I/O needed to conduct crew training? YES or NO. Why?

9. Would this device enhance combat readiness when deployed CONUS/OCONUS?

10. With the exception of the BGST, can the Embedded Trainer train the primary critical skills needed for gunnery and during combat?

11. How could you use this device in institutional training? In a hostile theatre? In a peacekeeping mission?

12. How could the Embedded Trainer support a unit commander during mission planning, mission rehearsal (actions on the objective), and unit maneuvers?

13. What features would you like to see added to the Embedded Trainer?

14. What else would you like to say about the Embedded Trainer device?

15. What do you think the BOIP should be for a BET?

16. Would you buy it?

17. Can it/should it replace the BATS?